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Novel Concept of Aligning the Molecules for Electronic Paper Displays

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Abstract

Flexibility is the way of future. Human mind is moving towards nanosize, so as devices. Future generation displays is more about electronic papers made up of plastic substrates. But the technology involved in this is rather complicated. Non-contact methods are only the solutions for generating future displays.

On the otherhand, the phenomenon of liquid crystal photoalignment became a subject of extensive research after the effect was discovered for the azobenzene units attached to a substrate and dispersed in a polymer matrix. Since then, huge variety of alignment materials has been developed for photonics related applications [1, 2]. Nevertheless, azo dye materials remain among the best candidates for technological application. The LC alignment produced by rubbing is not perfectly uniform, especially on a microscopic level. Because of this, alignment methods avoiding mechanical contact with the aligning substrates are being actively studied. Photoalignment is among the most promising candidates due to their non-contact nature, high uniformity, wide-range and smooth variation of the parameters of LC alignment.

Here we report first time the novel concept of photo aligning the surface of liquid crystals by unpoalrized UV light. Till today, all alignment method reported uses linear poalrized light to alignm the moelcules but we used unpolarized UV light to align the molecules which is unique and quiet straight forward method for device application is concerned. The proposed method is completely different than the method obtained so far in the industry or any academia or research groups.

Figure 1 shows the experimental method to produce nano layered alignment.

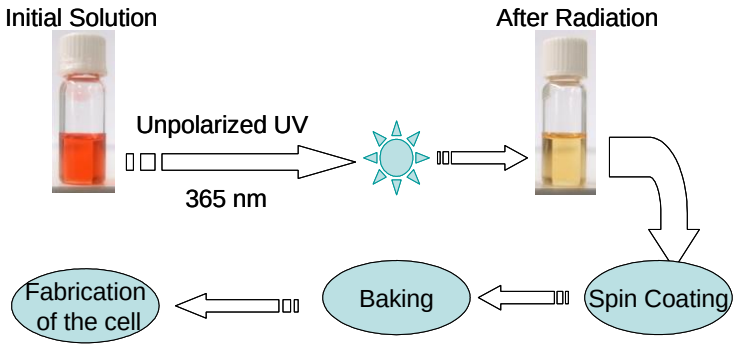

Figure 1: Experimental procedure for fabricating the cell. Unconventional method is employed here, in which solution is shined rather than the solid sample for aligning the liquid crystals.

Initial solution is irradiated with unpolarized UV light of wavelength 365 nm and then to spin coat the layers followed by sandwiching them in uniform cells of desired thickness followed by liquid crystal filling. One can see extremely good dark and bright states under the crossed polarizers with this method (see figure 2).

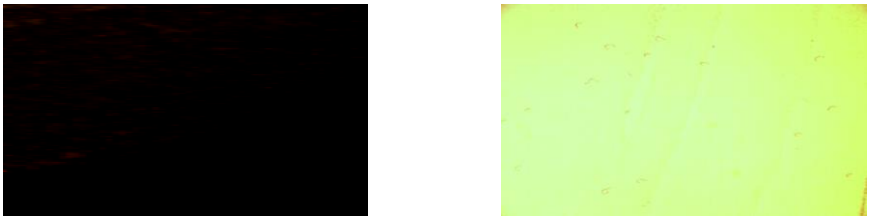

Figure 2: Showing excellent photoalignment quality of dark and bright states.

One can also control the quality of the cells, anchoring energy by illuminating the initial solutions with different UV exposure time. The color which we get can be used for different kind of applications which again depends on anchoring energy of the surfaces (see figure 3).

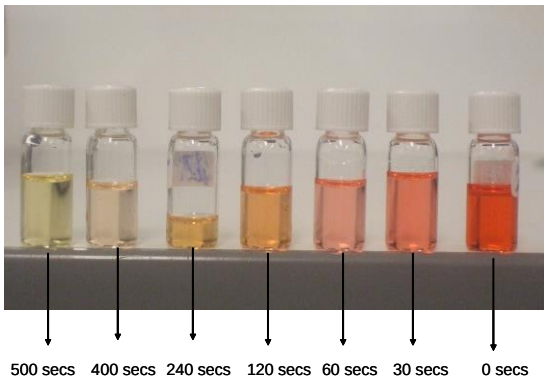

Figure 3. The bottles show the photoaligning solution with different exposures. So color change from red to yellow, very promisable for controlling anchoring energy just by changing exposure doses.

Presented method is highly suitable on plastics since it eliminates several steps for the industry and makes the process easier. Electronic papers industry which requires minimum steps of preparation and high quality materials can definitely adopt this method.

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